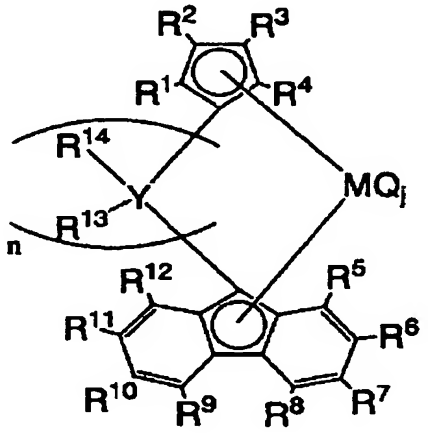
What we claim is,

1. A process for preparing a low molecular weight olefin (co)polymer comprising homopolymerizing or copolymerizing an olefin in the presence of an olefin polymerization catalyst comprising:

(A) a Group 4 transition metal compound represented by the following formula (1), and

(B) at least one compound selected from the group consisting of (B-1) an organometallic compound, (B-2) an organoaluminum compound, (B-3) an organoaluminum oxy-compound, and (B-4) a compound that reacts with the Group 4 transition metal compound (A) to form an ion pair;



... (1)

wherein R^1, R^2, R^3, R^4, R^5, R^6, R^7, R^8, R^9, R^{10}, R^{11}, R^{12}, R^{13} and R^{14} are independently selected from the group consisting of hydrogen, a hydrocarbon group, and a silicon-containing group, and are the same or different; and each adjacent pair of substituents R^1 to R^{14} may be taken together to form a ring; M

is Ti, Zr or Hf; Y is a Group 14 atom; each Q is independently selected from the group consisting of: a halogen, a hydrocarbon group, a neutral conjugated or non-conjugated diene having 10 or fewer carbon atoms, an anionic ligand, and a neutral ligand that can be coordinated with a lone electron pair; n is an integer of from 2 to 4; and j is an integer of from 1 to 4; wherein an intrinsic viscosity [η] of the low molecular weight olefin (co)polymer measured in decalin at 135°C is 0.6dl/g or less.

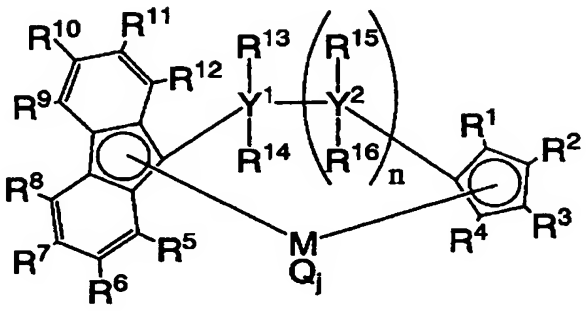
2. The process for preparing a low molecular weight olefin (co)polymer according to claim 1, wherein the intrinsic viscosity [η] of the low molecular weight olefin (co)polymer measured in decalin at 135°C is 0.4dl/g or less.

3. The process for preparing a low molecular weight olefin (co)polymer according to claim 1, wherein the low molecular weight olefin (co)polymer is obtained by homopolymerizing or copolymerizing, in an arbitrary combination, one or more olefin(s) having 2 to 20 carbon atoms.

4. The process according to claim 3, wherein at least one of the olefin(s) is ethylene, propylene, 1-octene, 1-decene, 1-dodecene or 1-tetradecene.

5. The process for preparing a low molecular weight olefin (co)polymer according to claim 1, wherein the Group 4 transition metal compound represented by the formula (1) is a Group 4

transition metal compound represented by the following formula (1');



. . . (1')

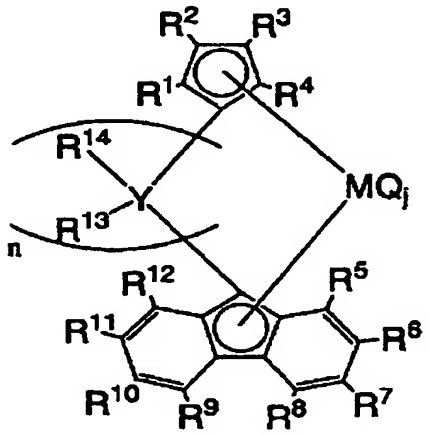
wherein R^1, R^2, R^3, R^4, R^5, R^6, R^7, R^8, R^9, R^{10}, R^{11} and R^{12} are independently selected from the group consisting of a hydrogen atom, a hydrocarbon group, and a silicon-containing group, and are the same or different; R^{13}, R^{14}, R^{15} and R^{16} are a hydrogen atom or a hydrocarbon group; n is an integer of from 1 to 3 and when n is 1, not all of the groups R^1 to R^{16} are hydrogen atoms, and each of the groups R^1 to R^{16} may be the same or different; each adjacent pairs of substituents R^5 to R^{12} may be taken together to form a ring; R^{13} and R^{15} may be taken together to form a ring, or the pair of R^{13} and R^{15} and the pair of R^{14} and R^{16} may be taken together to form rings simultaneously; Y^1 and Y^2 are Group 14 atoms, and may be the same or different from each other, M is Ti, Zr or Hf; each Q is independently selected from the group consisting of a halogen, a hydrocarbon group, an anionic ligand and a neutral ligand that can be coordinated with a lone electron pair; and j is an integer of from 1 to 4.

6. The process for preparing a low molecular weight olefin (co)polymer according to claim 1, wherein an average residence time of the polymerization is 2 hours or less.

7. An olefin polymerization catalyst suitable for preparing a low molecular weight olefin (co)polymer by homopolymerizing or copolymerizing an olefin, which comprises:

(A) a Group 4 transition metal compound represented by the following formula (1), and

(B) at least one compound selected from the group consisting of (B-1) an organometallic compound, (B-2) an organoaluminum compound, (B-3) an organoaluminum oxy-compound, and (B-4) a compound that reacts with the Group 4 transition metal compound (A) to form an ion pair;



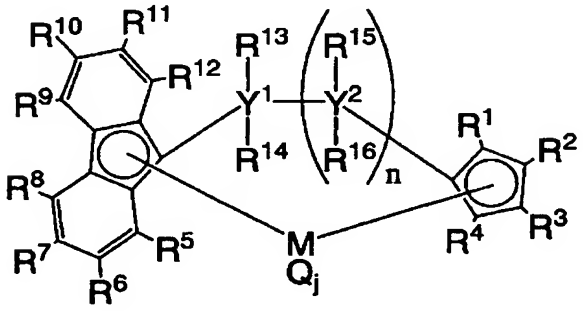
... (1)

wherein R^1, R^2, R^3, R^4, R^5, R^6, R^7, R^8, R^9, R^{10}, R^{11}, R^{12}, R^{13} and R^{14} are independently selected from the group consisting of hydrogen, a hydrocarbon group, and a silicon-containing group, and are the same or different; and each adjacent pair of

substituents R^1 to R^{14} may be taken together to form a ring; M is Ti, Zr or Hf; Y is a Group 14 atom; each Q is independently selected from the group consisting of: a halogen, a hydrocarbon group, a neutral conjugated or non-conjugated diene having 10 or fewer carbon atoms, an anionic ligand, and a neutral ligand that can be coordinated with a lone electron pair; n is an integer of from 2 to 4; and j is an integer of from 1 to 4.

8. The olefin polymerization catalyst according to claim 7, wherein the Group 4 transition metal compound represented by the general formula (1) is a Group 4 transition metal compound represented by the said formula (1').

9. A Group 4 transition metal compound represented by the following formula (1');



. . . (1')

wherein R^1, R^2, R^3, R^4, R^5, R^6, R^7, R^8, R^9, R^{10}, R^{11} and R^{12} are independently selected from the group consisting of a hydrogen atom, a hydrocarbon group, and a silicon-containing group, and may be the same or different; each of R^{13}, R^{14}, R^{15} and R^{16} is

independently a hydrogen atom or a hydrocarbon group; n is an integer of from 1 to 3 and when n is 1, not all of the R^1 to R^{16} are hydrogen atoms, and each of the R^1 to R^{16} may be the same or different; each adjacent pair of substituents R^5 to R^{12} may be taken together to form a ring; R^{13} and R^{15} may be taken together to form a ring, or the pair of R^{13} and R^{15} and the pair of R^{14} and R^{16} may be taken together to form rings simultaneously; each of Y^1 and Y^2 is a Group 14 atom, and may be the same or different; M is Ti, Zr or Hf; each Q is independently selected from a group consisting of halogen, a hydrocarbon group, an anionic ligand and a neutral ligand that can be coordinated with a lone electron pair; and j is an integer of from 1 to 4].

10. The Group 4 transition metal compound according to claim 9, wherein n is 1 or 2, and each of Y^1 and Y^2 is a carbon atom or a silicon atom, in the formula (1').

11. The Group 4 transition metal compound according to claim 9, wherein two or more of the substituents R^6, R^7, R^{10} and R^{11} are hydrocarbon groups having 1 to 20 carbon atoms, in the formula (1').

12. The group 4 transition metal compound according to claim 9, wherein R^6 and R^7 are taken together to form an aliphatic ring, and R^{10} and R^{11} are taken together to form an aliphatic ring, in the formula (1').